CLAIMS

1. A method for fabricating a substantially metal part, comprising the steps of:

a. providing a skeleton of interconnected adhered metal powder having a network of interconnected porosities throughout, said metal powder composed of at least two elements;

b. providing an infiltrant comprising:

i. the same at least two elements as are in the skeleton; and

ii. melting point depressant (MPD);

the infiltrant having a composition that is a liquidus composition for an infiltration temperature; and

c. infiltrating said skeleton with said infiltrant, at approximately said infiltration temperature, whereby essentially no erosion of said skeleton transpires.

2. The method of claim 1, further comprising the step of subjecting said infiltrated skeleton to conditions such that at least some of said MPD diffuses from said infiltrated porosities into said metal powder, and diffusional solidification occurs.

3. The method of claim 1, said step of providing infiltrant comprising: providing, in a vessel, an infiltrant supply having a bulk composition within a multi-phase field where at said infiltration temperature solid is present and liquid is present at a liquidus composition, and further comprising the steps of:

a. melting a portion of said infiltrant supply; and

b. agitating said melted portion of said infiltrant supply throughout its volume, to a degree that ensures that said liquid remains at said liquidus composition.

4. The method of claim 3, said step of agitating comprising stirring said melted portion of said infiltrant supply.

5. The method of claim 3, said step of agitating comprising bubbling gas through said melted infiltrant supply.

6. The method of claim 3, said step of agitating comprising shaking said melted infiltrant supply.

7. The method of claim 3, said step of agitating comprising applying an electromagnetic inductive field to said melted infiltrant precursor supply.

8. The method of claim 3, said step of agitating comprising tipping said vessel back and forth.

9. The method of claim 2, said step of subjecting said infiltrated skeleton to temperature conditions such that diffusional solidification occurs, comprising subjecting said skeleton to a temperature range that exceeds said infiltration temperature.

10. The method of claim 9, said step of subjecting said infiltrated skeleton to a temperature range that exceeds said infiltration temperature comprising maintaining said infiltrated skeleton at substantially constant temperature, such that solidification occurs substantially isothermally.

11. The method of claim 1, said step of infiltrating said porosities of said skeleton with said melted infiltrant comprising substantially fully filling substantially all of said network of interconnected porosities with said melted infiltrant.

12. The method of claim 2, said step of subjecting said infiltrated skeleton to temperature conditions such that said MPD diffuses comprising subjecting said infiltrated skeleton to temperature conditions such that said MPD diffuses from said infiltrated network of porosities into and substantially throughout said metal powder.

13. The method of claim 1,

a. wherein said step of providing infiltrant comprises providing, in a vessel, an infiltrant supply, having a bulk composition that is in an equilibrium multiple phase field at said infiltration temperature, such that solid is present and liquid is present at a liquidus composition;

and further comprising the step of:

b. overheating said infiltrant supply to a temperature that exceeds said infiltration temperature and maintaining said overheating such that at least some of said infiltrant that is solid in said multiple phase field becomes liquid.

14. A method for fabricating a substantially metal part, comprising the steps of:

a. providing a skeleton of interconnected adhered metal powder having a network of interconnected porosities throughout, said metal powder composed of two or more elements, chosen as in step e below;

b. providing an infiltrant comprising:

i. the same elements as are in the skeleton; and

ii. melting point depressant;

the infiltrant having a composition that is a liquidus composition for an infiltration temperature, the liquidus composition and infiltration temperature chosen as in step e below;

c. infiltrating said skeleton at said infiltration temperature with said infiltrant in liquid form;

d. subjecting said infiltrated skeleton to conditions such that a portion of said melting point depressant diffuses from said infiltrated porosities into said metal powder, and at least partial diffusional solidification occurs; and

e. choosing said metal powder composition, melting point depressant, infiltrant composition and infiltration temperature such that during diffusional solidification of said infiltrant, relative ratios, of components other than melting point depressant, in said liquid infiltrant not yet solidified, remain constant.

15. The method of claim 14, said melting point depressant consisting essentially of a single element.

16. The method of claim 14, said melting point depressant consisting essentially of two or more elements, all of which have similar mass transport characteristics relative to said elements of said skeleton.

17. The method of claim 14, said step of subjecting said infiltrated skeleton to conditions such that at least partial diffusional solidification occurs comprising subjecting said infiltrated skeleton to constant temperature

conditions such that at least partial isothermal solidification occurs.

18. The method of claim 14, said step of subjecting said infiltrated skeleton to conditions such that at least partial diffusional solidification occurs comprising subjecting said infiltrated skeleton to reducing temperature conditions.

19. The method of claim 14, said skeleton further comprising melting point depressant.

20. The method of claim 14, said skeleton being substantially free of melting point depressant.

21. The method of claim 14, said step of choosing comprising choosing said metal powder composition, melting point depressant, infiltrant composition and infiltration temperature such that a liquidus composition and a solidus composition of said infiltrant, that are joined by a tie line on an equilibrium phase diagram, both lie on a line of constant relative proportions of non-MPD components of said infiltrant.

22. The method of claim 21, said step of choosing comprising choosing said metal powder composition, melting point depressant, infiltrant composition and infiltration temperature such that the composition of said skeleton, lies on said line of constant relative proportions of non-MPD components of said infiltrant.

23. A method for fabricating a substantially metal part, comprising the steps of:

a. providing a skeleton of interconnected adhered metal powder having a network of interconnected porosities throughout, said metal powder comprising a single metal;

b. providing an infiltrant comprising:

i. the same metal as is in the skeleton; and

ii. melting point depressant consisting essentially of a single element;

the infiltrant having a composition that is the liquidus composition for an infiltration temperature;

c. infiltrating said skeleton at said infiltration temperature with said infiltrant in liquid form;

d. subjecting said infiltrated skeleton to conditions such that a portion of said melting point depressant diffuses from said infiltrated porosities into said metal powder, and at least partial diffusional solidification occurs.

24. The method of claim 23, said step of subjecting said infiltrated skeleton to conditions such that at least partial diffusional solidification occurs comprising subjecting said infiltrated skeleton to constant temperature conditions such that at least partial isothermal solidification occurs.

25. The method of claim 23, said step of subjecting said infiltrated skeleton to conditions such that at least partial diffusional solidification occurs comprising subjecting said infiltrated skeleton to reducing temperature conditions.

26. The method of claim 23, said skeleton further comprising melting point depressant.

27. The method of claim 23, said skeleton being free of melting point depressant.

28. A method for fabricating a substantially metal part, comprising the steps of:

a. providing a skeleton of interconnected adhered metal powder having a network of interconnected porosities throughout, said powder packed at a packing fraction, said metal powder composed of at least one element, chosen as in step e below;

b. providing an infiltrant comprising:

i. the same at least one elements as are in the skeleton; and

ii. melting point depressant;

the infiltrant having a composition that is a liquidus composition for an infiltration temperature, the liquidus composition and infiltration temperature chosen as in step e below;

c. infiltrating said skeleton at said infiltration temperature with said infiltrant in liquid form;

d. subjecting said infiltrated skeleton to conditions such that a portion of said melting point depressant diffuses from said infiltrated porosities into said metal powder, and at least partial diffusional solidification occurs; and

e. choosing skeleton packing fraction, said metal powder composition, melting point depressant, infiltrant composition and infiltration temperature such that after diffusional solidification of said infiltrant is complete, an interconnected network of liquid, remains substantially throughout said skeleton.

29. The method of claim 28, further wherein said interconnected network of liquid is sufficiently porous to permit flow of infiltrant therethrough.

30. The method of claim 28, further comprising the step of subjecting said infiltrated skeleton to lower temperature conditions such that all of said infiltrant solidifies such that said infiltrated skeleton achieves a bulk composition substantially identical to that of a casting of said infiltrant.

31. A method for fabricating a substantially metal part, comprising the steps of:

a. providing a skeleton of interconnected adhered metal powder having a network of interconnected porosities throughout a geometry, said metal powder composed of at least one element, chosen as in step e below, with powder particle composition and characteristics chosen as in step e below;

b. providing an infiltrant comprising:

i. the same elements as are in the skeleton; and

ii. melting point depressant;

the infiltrant having a composition, chosen as in step e below;

c. infiltrating said skeleton at an infiltration temperature chosen as in step e below, with said infiltrant in liquid form;

d. subjecting said infiltrated skeleton to conditions such that after said step of infiltration has substantially completed such that said skeleton geometry is fully infiltrated, a portion of said melting point

depressant diffuses from said infiltrated porosities into said metal powder, and at least partial diffusional solidification occurs; and

e. choosing said metal powder composition, melting point depressant, infiltrant composition and infiltration temperature and metal particle size, size distribution, and surface roughness, such that said infiltrant infiltrates throughout substantially all of said network of interconnected porosities before essentially any of said diffusional solidification has occurred;

whereby said infiltrated skeleton is substantially free of compositional gradient along a direction of infiltration.

32. The method of claim 31, said step of choosing, in the case of infiltrating without opposing gravity, comprising choosing a representative size of said powder material, and, then if the resultant rate of infiltration is too slow to infiltrate substantially all of said network before any diffusional solidification occurs, choosing a relatively larger representative size of powder particle to increase the rate of infiltration.

33. The method of claim 31, said step of choosing, in the case of infiltrating against gravity, comprising choosing a representative size of said powder material, and, then if the resultant rate of infiltration is too slow to infiltrate substantially all of said skeleton before any diffusional solidification occurs, choosing a relatively larger representative size of powder particle to increase the rate of infiltration, but limiting the choice of relatively larger size particles to a particles small enough to achieve a capillary driving force to overcome gravity to the full height of said geometry.

34. The method of claim 31, said step of choosing, in the case of infiltrating against gravity, having an acceleration g, in a skeleton having a geometry with height h, comprising choosing:

said powder to have a surface area S_p of the pore space in the skeleton and a volume V_p of the pore space in the skeleton;

said infiltrant to have a liquid density ρ, and liquid/vapor interfacial energy γ_{LV}, and a contact angle θ with the solid of the skeleton powder, such that:

$$\frac{\gamma_{LV}\cos(\theta)S_p}{V_p} > \rho g h .$$

35. The method of claim 34, said step of choosing, further comprising choosing substantially mono-modal spherical particles, and choosing said skeleton to have a void fraction ε and said spherical particles to having a diameter D, such that:

$$\frac{\gamma_{LV}\cos(\theta)6(1-\varepsilon)}{D\varepsilon} > \rho g h .$$

36. A method for fabricating a substantially metal part, comprising the steps of:

a. providing a skeleton of interconnected adhered metal powder having a network of interconnected porosities throughout a geometry, said metal powder composed of at least one element, chosen as in step e below, with powder particle composition and characteristics chosen as in step e below;

b. providing an infiltrant comprising:

i. the same elements as are in the skeleton; and

ii. melting point depressant;

the infiltrant having a composition chosen as in step e below;

c. infiltrating said skeleton at an infiltration temperature, chosen as in step e below, with said infiltrant in liquid form;

d. subjecting said infiltrated skeleton to conditions such that after said step of infiltration has been substantially completed such that said skeleton geometry is fully infiltrated, a portion of said melting point depressant diffuses from said infiltrated porosities into said metal powder, and diffusional solidification occurs to an extent that blocks off flow of infiltrant throughout said interconnected porosities; and

e. choosing said metal powder composition, said melting point depressant, said infiltrant composition said infiltration temperature, said metal particle size, and metal particle size distribution, and surface roughness, such that said infiltrant infiltrates throughout substantially all of said network of interconnected porosities before diffusional solidification occurs to an extent that blocks off flow of infiltrant throughout said interconnected porosities.

37. A method for infiltrating a substantially metal part, comprising the steps of:

a. providing a skeleton having:

i. an interconnected adhered metal powder body having a network of interconnected porosities throughout, said porosities having a characteristic pore size;

ii. at least one infiltrant contact surface; and

iii. at least one feeder channel having a characteristic diameter d that is at least three times said pore size, said feeder channel extending from said infiltrant contact surface to a first internal region of said network of porosities;

b. providing, an infiltrant supply;

c. subjecting said infiltrant supply to an infiltration temperature under conditions that melt at least a portion of said infiltrant supply;

d. contacting said infiltrant contact surface of said skeleton to said melted infiltrant supply, such that liquid infiltrant passes through said feeder channel to said internal region; and

e. subjecting said skeleton to conditions such that said liquid infiltrant infiltrates said interconnected porosities of said skeleton, including said internal region.

38. The method of claim 37,

a. said infiltrant comprising:

i. the same elements as are in the skeleton; and

ii. melting point depressant;

b. further comprising the steps of:

i. subjecting said infiltrated skeleton to temperature conditions such that a portion of said melting point depressant diffuses from said infiltrated porosities into said metal powder; and

ii. subjecting said infiltrated skeleton to temperature conditions such that infiltrant that has infiltrated said porosities, solidifies.

39. The method of claim 38, said network of porosities having a diffusional solidification related penetration distance limit (PL), said skeleton having a geometry and dimension such that a second internal region of said network of interconnected porosities is;

a. spaced from said infiltrant contact surface a distance that exceeds said penetration distance limit; and

b. spaced from said feeder channel a distance that is less than said penetration distance limit;

whereby said infiltrant infiltrates said skeleton to said second internal region through said feeder channel, beyond said penetration distance limit from said infiltrant contact surface.

40. The method of claim 38, said feeder channel having a diameter of at least five times said characteristic pore size.

41. The method of claim 38, said skeleton having a geometry and dimension from said infiltrant contact surface, such that infiltrant must travel to a height h above said infiltrant contact surface to reach said second internal region of said network of porosities, said feeder channel having a radius r that is less than:

$$\frac{2\gamma\cos(\theta)}{\rho g h},$$

where ρ is the density of said liquid infiltrant, g is acceleration due to gravity, γ_{LV} is the liquid/vapor

interfacial energy, and θ is the contact angle of the liquid with the solid.

42. The method of claim 39, said skeleton having a geometry and dimension from said infiltrant contact surface, such that infiltrant must travel to a height z above said infiltrant contact surface to reach said second internal region of said network of porosities, said feeder channel having a radius r that is less than:

$$\frac{2\gamma\cos(\theta)}{\rho g(z-PL)},$$

where ρ is the density of said liquid infiltrant, g is acceleration due to gravity, γ_{LV} is the liquid/vapor interfacial energy, and θ is the contact angle of the liquid with the solid.

43. The method of claim 38, said feeder channel comprising a channel having a characteristic diameter of between five and ten times said characteristic pore size.

44. The method of claim 38, said skeleton comprising a feeder channel having at least two portions, inclined relative to each other.

45. The method of claim 38, said feeder channel having a characteristic diameter that varies along its length.

46. The method of claim 37, said at least one feeder channel comprising a network of feeder channels.

47. A skeleton, for use fabricating a substantially metal part, said skeleton comprising:

a. an interconnected adhered metal powder body having a network of interconnected porosities throughout, said porosities having a characteristic pore size;

b. at least one infiltrant contact surface; and

c. at least one feeder channel having a characteristic diameter d that is at least three times said pore size, said feeder channel extending from said infiltrant contact surface to a first internal region of said network of porosities.

48. The skeleton of claim 46, said network of porosities having a diffusional solidification related penetration distance limit, said skeleton having a geometry and dimension such that a second internal region of said network of interconnected porosities is:

a. spaced from said infiltrant contact surface a distance that exceeds said penetration distance limit; and

b. spaced from said feeder channel a distance that is less than said penetration distance limit.

49. The skeleton of claim 48, said feeder channel having a diameter of at least five times said characteristic pore size.

50. The skeleton of claim 47, for use with a liquid infiltrant having a density ρ and a liquid/vapor interfacial energy γ_{LV} and a contact angle θ with powder of said skeleton, said skeleton having a geometry and dimension from said infiltrant contact surface, such that infiltrant must travel to a height h above said infiltrant contact surface to reach said second internal region of said network of porosities, said feeder channel having a radius r that is less than:

$$\frac{2\gamma\cos(\theta)}{\rho g h},$$

where g is accelleration due to gravity.

51. The skeleton of claim 48, said feeder channel having a characteristic diameter of between five and ten times said characteristic pore size.

52. The skeleton of claim 48, further comprising a feeder channel having at least two portions, inclined relative to each other.

53. The skeleton of claim 48, further comprising a feeder channel having a characteristic diameter that varies along its length.

54. The skeleton of claim 48, further comprising a network of feeder channels.

55. A method for infiltrating a substantially metal part, comprising the steps of:

a. providing a skeleton of interconnected adhered metal first powder having a surface and a network of interconnected porosities throughout, said powder having a relatively larger characteristic particle size;

b. substantially covering said surface of said skeleton with a covering layer comprising relatively fine metallic powder, said relatively fine powder having a characteristic size that is significantly smaller than said relatively larger characteristic size;

c. providing, in a vessel, an infiltrant supply;

d. subjecting said infiltrant supply to an infiltration temperature, under conditions that melt a portion of said infiltrant supply;

e. contacting said skeleton to said melted infiltrant supply, such that infiltrant is drawn into said skeleton through said relatively larger metal powder by capillary action;

f. infiltrating said interconnected porosities of said relatively larger metal powder with said melted infiltrant and infiltrating said covering layer with said melted infiltrant, via said interconnected porosities of said relatively larger metal powder.

56. The method of claim 55,

a. said infiltrant comprising:

i. the same elements as are in the first powder of said skeleton; and

ii. melting point depressant;

b. further comprising the steps of:

i. subjecting said infiltrated skeleton to temperature conditions such that a portion of said melting point depressant diffuses from said infiltrated porosities into said relatively larger metal powder; and

ii. subjecting said infiltrated skeleton to temperature conditions such that infiltrant that has infiltrated said porosities, solidifies.

57. The method of claim 56, further, wherein an interconnected network of porosities within a body of interconnected adhered said fine powder has a diffusional solidification related penetration distance limit, said skeleton having a geometry and dimension such that:

a. a region of said fine covering layer is spaced from said infiltrant contact surface a distance that exceeds said penetration distance limit; and

b. said covering layer has a thickness that is less than said penetration distance limit;

whereby said infiltrant infiltrates said fine covering layer through said interconnected porosities of said relatively larger metal powder, beyond said penetration distance limit from said infiltrant contact surface.

58. The method of claim 56, said covering layer comprising relatively fine metallic powder having particle sizes that are between approximately 1/10 and approximately 1/100 said relatively larger characteristic particle size.

59. The method of claim 56, said step of applying a covering layer comprising applying said layer to said surface of said skeleton to create a skin of finer powder over said relatively larger metal particles at said surface.

60. The method of claim 56, said step of applying a covering layer comprising applying said covering layer to said surface of said skeleton so that said covering layer penetrates into porosities between said relatively larger metal powder, leaving particles of said relatively larger metal powder at said surface with, at most, a thin covering layer of said finer powder.

61. The method of claim 56, wherein:

a. said covering layer comprises a paste having a polymeric vehicle; and

b. further comprising the step of subjecting said paste covered skeleton to temperature conditions such that said polymeric vehicle burns off and is substantially eliminated from said paste and said relatively fine powder particles are sintered into place.

62. A skeleton, for use fabricating a substantially metal part, said skeleton comprising:

a. an interconnected network of adhered metal first powder having a surface and a network of interconnected porosities throughout, said powder having a relatively larger characteristic particle size; and

b. covering said surface of said skeleton, a covering layer comprising relatively fine metallic powder, said relatively fine powder having a characteristic size that is significantly smaller than said relatively larger characteristic size.

63. The skeleton of claim 62, wherein an interconnected network of porosities within a comparison body of interconnected adhered said fine powder has a diffusional solidification related penetration distance limit, said skeleton having a geometry and dimension such that:

a. a region of said fine covering layer is spaced from said infiltrant contact surface a distance that exceeds said penetration distance limit; and

b. said covering layer has a thickness that is less than said penetration distance limit.

64. The skeleton of claim 63, said covering layer comprising relatively fine metallic powder having particle sizes that are between approximately 1/10 and approximately 1/100 said relatively larger characteristic particle size.

65. The skeleton of claim 62, said covering layer covering said surface of said skeleton to form a skin of finer powder over said relatively larger metal particles at said surface.

66. The skeleton of claim 62, said covering layer penetrating said surface of said skeleton into porosities between said relatively larger metal powder, leaving

particles of said relatively larger metal powder at said surface substantially bare of said finer powder.

67. The skeleton of claim 62, said covering layer further comprising a polymeric vehicle.

68. The skeleton of claim 62, said covering layer comprising a sintered layer of fine powder.

69. A method for infiltrating a substantially metal part, comprising the steps of:

a. providing a skeleton of interconnected adhered metal powder having a network of interconnected porosities throughout, said powder particles having:

i. a size and shape such that, if smooth, said particles would have a nominal surface area; and

ii. a surface texture that gives rise to an actual surface area that exceeds said nominal surface area by between approximately 25% and 500% of said nominal surface area;

b. providing, an infiltrant supply comprising:

i. the same elements as are in the skeleton; and

ii. melting point depressant;

c. subjecting said infiltrant supply to an infiltration temperature, under conditions that melt at least a portion of said infiltrant supply;

d. contacting said skeleton to said melted infiltrant supply, such that liquid infiltrant is drawn into said skeleton through said network of porosities by capillary action;

e. infiltrating said interconnected porosities of said skeleton with said melted infiltrant.

f. subjecting said infiltrated skeleton to temperature conditions such that a portion of said melting point depressant diffuses from said infiltrated porosities into said metal powder; and

g. subjecting said infiltrated skeleton to temperature conditions such that infiltrant that has infiltrated said porosities, solidifies;

wherein a comparison network of porosities identical to said network, but for having a representative particle surface area equal to said nominal surface, area having a diffusional solidification related penetration distance limit (PL), said skeleton having a geometry and dimension such that a region of said network of interconnected porosities is spaced from said infiltrant contact surface a distance that exceeds said penetration distance limit of said comparison network;

whereby said infiltrant infiltrates said skeleton to said region of said network by capillarity through said interconnected porosities of particles having a surface area that exceeds said smooth surface area, beyond said penetration distance limit, from said infiltrant contact surface.

70. The method of claim 69, said skeleton of powder particles comprising hydrometallugically processed powder.

71. The method of claim 69, said powder particles comprising vapor phase etched powder.

72. The method of claim 69, said powder particles comprising the relatively large powder particles that are each coated with a layer of powder particles that are smaller

than said relatively large particles, said smaller particles having a size between 1/1000 and 1/10 the size of said relatively large particles.

73. A method for infiltrating a substantially metal part, comprising the steps of:

a. providing a skeleton having:

i. an interconnected adhered metal powder body having a network of interconnected porosities throughout;

ii. at least two infiltrant contact surfaces; and

iii. for each infiltrant contact surface, at least one infiltrant supply tab coupled to said respective infiltrant contact surface;

b. providing, an infiltrant supply comprising:

i. the same elements as are in the skeleton; and

ii. melting point depressant;

c. subjecting said infiltrant supply to an infiltration temperature under conditions that melt at least a portion of said infiltrant supply;

d. coupling each of said infiltrant supply tabs to said melted portion of said infiltrant supply, such that liquid infiltrant passes through said supply tab to said respective infiltrant contact surface;

e. subjecting said skeleton to conditions such that said liquid infiltrant infiltrates said interconnected porosities of said skeleton, including regions adjacent said infiltrant contact surfaces;

f. subjecting said infiltrated skeleton to temperature conditions such that a portion of said melting point depressant diffuses from said infiltrated porosities into said metal powder; and

g. subjecting said infiltrated skeleton to temperature conditions such that infiltrant that has infiltrated said porosities, solidifies.

74. The method of claim 73, said fluid supply tabs comprising hollow tubes.

75. The method of claim 73, said fluid supply tabs comprising tubes that are integral with said skeleton.

76. A method for fabricating a substantially metal part, comprising the steps of:

a. providing a skeleton of interconnected adhered metal powder having a network of interconnected porosities throughout, said metal powder composed of iron;

b. providing an infiltrant comprising:

i. the same elements as are in the skeleton; and

ii. melting point depressant (MPD) comprising an alloy of iron, carbon, manganese, silicon, chromium, nickel and molybdenum;

c. infiltrating said interconnected porosities with said infiltrant in liquid form;

d. subjecting said infiltrated skeleton to temperature conditions such that said melting point depressant diffuses from said infiltrated voids into said metal powder; and

e. subjecting said infiltrated skeleton to temperature conditions such that infiltrant that has infiltrated into said interconnected porosities, solidifies.

77. A method for fabricating a substantially metal part, comprising the steps of:

a. providing a skeleton of interconnected adhered metal powder having a network of interconnected porosities throughout, said metal powder composed of iron;

b. providing an infiltrant comprising:

i. the same elements as are in the skeleton; and

ii. melting point depressant (MPD) comprising an alloy of iron, carbon, manganese, silicon, chromium, nickel, copper and niobium;

c. infiltrating said interconnected porosities with said infiltrant in liquid form;

d. subjecting said infiltrated skeleton to temperature conditions such that said melting point depressant diffuses from said infiltrated voids into said metal powder; and

e. subjecting said infiltrated skeleton to temperature conditions such that infiltrant that has infiltrated into said interconnected porosities, solidifies.

78. A method for fabricating a substantially metal part, comprising the steps of:

a. providing a skeleton of interconnected adhered metal powder having a network of interconnected porosities throughout, said metal powder comprising titanium;

b. providing an infiltrant comprising:

i. the same elements as are in the skeleton; and

ii. melting point depressant (MPD) comprising silicon;

c. infiltrating said interconnected porosities with said infiltrant in liquid form;

d. subjecting said infiltrated skeleton to temperature conditions such that said silicon diffuses from said infiltrated voids into said metal powder; and

e. subjecting said infiltrated skeleton to temperature conditions such that infiltrant that has infiltrated into said interconnected porosities, solidifies.

79. A method for fabricating a substantially metal part, comprising the steps of:

a. providing a skeleton of interconnected adhered metal powder having a network of interconnected porosities throughout, said metal powder comprising titanium;

b. providing an infiltrant comprising:

i. the same elements as are in the skeleton; and

ii. melting point depressant (MPD) comprising at least one material selected from the group

consisting of: aluminum, tin, zirconium, molybdenum, vanadium, copper and chromium;

c. infiltrating said interconnected porosities with said infiltrant in liquid form;

d. subjecting said infiltrated skeleton to temperature conditions such that said melting point depressant diffuses from said infiltrated voids into said metal powder; and

e. subjecting said infiltrated skeleton to temperature conditions such that infiltrant that has infiltrated into said interconnected porosities, solidifies.

80. The method of claim 14, further comprising choosing said metal powder composition, such that relative ratios, of components other than melting point depressant, are equal to said relative ratios, of components other than melting point depressant, in said infiltrant.